CHECKOUT & ADJUSTMENT PROCEDURES

AR-140

Optional DR REC/REP Amp Unit

for

XR Series Data Recorder

GENERAL ELECTRIC
INSTRUMENTATION & COMMUNICATION
1200 KONA DRIVE
COMPTON, CA 90220
(213) 642-5317

TEAC

CONTENTS

1. Overview 1
2. Specifications (AR-140 DR Amp for XR Series Data Recorder) 2
3. Required Test Equipment and Specified Tools 2
4. Adjustment Preparation and Precautions 2
5. Operating Instructions 7
6. Recording Data 8
6.1 Checking Input Zero Adj. 8
6.2 Calibration 8
6.3 Record the Data 8
7. Reproducing the Data 9
8. DR REC/REP Amp Unit PCBA 10
9. DR REC/REP Amp Unit Schematic Diagram 11

1. Overview

An exclusive use of DR Record/Reproduce amp unit for TEAC XR data recorder is provided by circuitry as shown below.

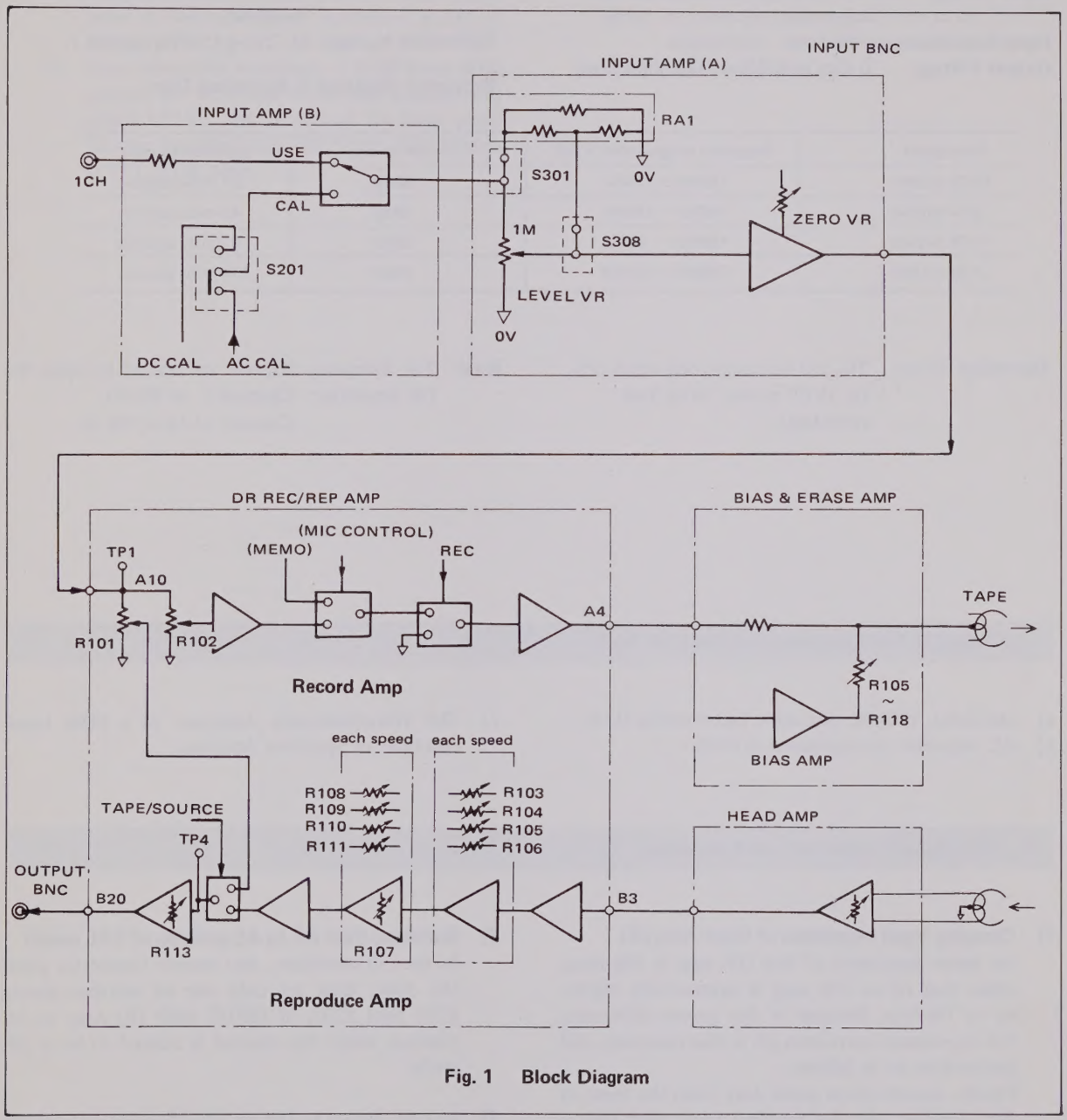


Fig. 1 Block Diagram

All the channels of the XR series are of FM specifications, however, by replacing the FM REC/REP AMP PCBA, Channels 1 to 12 can be converted into DR specifications. (Channels 13 and 14 cannot be used they are assigned for NOISE COMP, tape servo, memo announce, and carrier detector.) The following adjustments and changes are necessary in addition to replacing the PCBA.

Change input impedance from 1 megohms to 10 kilohms by strapping the input amplifier switch (short bar).

2. Specifications (AR-140 DR Amp for XR Series Data Recorder)

Required tape: T-120, TEAC specified
Input Voltage: ±1V thru to ±10V continuously adjustable
Input Impedance: 10kohms
Output Voltage: 0 thru to ±2V (at 100kohms load, continuously adjustable)
*No current output specified is available.
Calibration Voltage: AC 2Vp-p (500Hz approx.)

Frequency Response & Recording Time:

Tape speed	Response range within ±3dB	S/N in rms	Duration in mins
19.05 cm/sec	100Hz ~ 37kHz	30dB	21 mins approx.
9.52 cm/sec	100Hz ~ 18kHz	30dB	43 mins approx.
4.76 cm/sec	100Hz ~ 9kHz	30dB	87 mins approx.
2.38 cm/sec	100Hz ~ 4.5kHz	30dB	174 mins approx.

Distortion Factor: The 3rd harmonics distortion: 1% (at 19.05 cm/sec, 3kHz Test recording)

Note: The following channels are limited to equip the DR Amplifier: Channel-7 of XR-30, Channel 13-14 of XR-50.

3. Required Test Equipment and Specified Tools

a) Oscillator: 100kHz, distortion factor within 0.1%
b) AC voltmeter: hp equivalent to 400E
c) The Third-harmonics Analyser: of a 9kHz band-pass filter or Spectrum Analyser.

4. Adjustment Preparation and Precautions

1) Changing Input Impedance of Input Amp (A)
An input impedance of this DR amp is 10kohms, while that of an FM amp is substantially higher; up to 1Mohms. Because of this greater difference, this impedance conversion job is thus necessary, and instructions are as follows:
Firstly, remove Dress panel Assy from the front of the recorder, cap the supplied short plug over a corresponded channel terminal which is predetermined to change to DR, among S301 thru S314, (e.g., if CH-1 is subjective, capping across S301 and S308 is shorted).

2) Switching from DC to AC position of CAL switch
In the (1) condition, also remove Connector panel (A) Assy, then set only one of switches among S201 thru S207, of INPUT AMP (B) Assy to AC position where the channel is desired to be in DR mode.

3) Re-lable letters to DR on labels located on a chassis inside of the right hand side panel viewing toward the front and on the rear panel for later identifying purpose.

4) Set S1 of DR REC/REP Amp PCB Assy to position 1 (toward Mother board side)

5) Input Amp Adjustment (only channel equipped DR Amp)

a) Setup: apply a 0V to INPUT BNC
USE-CAL sw: USE
Adjust a ZERO shift VR control of the front panel so that a 0V ±5mV is attained at TP1 of DR Amp.

b) Input sinusoidal waveform of 0.707Vrms 3kHz approx, set USE-CAL sw to USE position and adjust LEVEL VR control of the front panel for the specified 1.6V ±0.1Vrms that appears at TP1 of DR Amp.

6) Aligning AC CAL-ibration voltage

Use the CH-annel adjusted by b) of above, adjust R14 of SW and CAL (B) Amp so that TP1 of DR Amp coincidents to 1.6 ±0.1Vrms (errors should be within ±0.01Vrms with DVM).

Note: If it has been set to 1.62Vrms in the b) of 5) adjustment, then also align this to coninci-dent to the same.

<table>
<tr><th>test item</th><th>specifications</th><th>check point/adj location</th><th>setups & adjustment</th></tr>
<tr><td>① Amp to Amp Gain Adj</td><td>0.707V rms
±0.02V rsm</td><td>TP4 of DR AMP

R101 of DR AMP</td><td>Input: apply sinewave of 0.707V rms, 3kHz to INPUT BNC.
setup: USE-CAL: USE
TAPE-SOURCE: SOURCE
STOP
USE DVM</td></tr>
<tr><td>② Bias Current Setup Adj</td><td>−3dB</td><td>TP2 of DR Amp,
adjust R105 thru R118 of BIAS & ERASE Amp</td><td>Input: apply sinewave of 37kHz, 0.707V rms to INPUT BNC.
setup: USE-CAL sw: USE
speed: 19cm/s
R102: tuneable center

Turn BIAS adj control VR of BIAS & ERASE Amp clockwise and set it to the point where a −3dB blow peak of the curve is obtainable.</td></tr>
<tr><td>③ Record Current Adj</td><td></td><td>TP2 of DR Amp

R102 of DR Amp</td><td>Input: sinewave 3kHz, 0.707V rms to INPUT BNC.
setup: USE-CAL: USE
Run tape at 19cm/s in simultaneous record/reproduce mode.
R103: turneable center

Adjust R102 for obtaining a 1% of the 3rd harmonics component (9kHz).</td></tr>
<tr><td>④ Low-Frequency Equalizer Adj</td><td><table><tr><th>speed</th><th>control</th><th>volume</th></tr><tr><td>38 cm/s</td><td></td><td></td></tr><tr><td>19 cm/s</td><td>3.7kHz → 37kHz
−5dB (+0.2, −0.5)</td><td>R103</td></tr><tr><td>9.5 cm/s</td><td>1.8kHz → 18kHz
−4dB (±0.2)</td><td>R104</td></tr><tr><td>4.8 cm/s</td><td>900Hz → 9kHz
−3dB (±0.2)</td><td>R105</td></tr><tr><td>2.4 cm/s</td><td>450Hz → 4.5kHz
−3dB (±0.2)</td><td>R106</td></tr><tr><td>1.2 cm/s</td><td></td><td></td></tr></table></td><td>TP2 of DR Amp,
adjust controls is shown in the left.</td><td>Input: sinewave of 0.707V rms to INPUT BNC.
speed: by each of speeds as listed.
setup: USE-CAL: USE
mode: simultaneous record/reproduce</td></tr>
<tr><td>⑤ High-Frequency Equalizer Adj</td><td><table><tr><th>speed</th><th>control</th><th>volume</th></tr><tr><td>38 cm/s</td><td></td><td></td></tr><tr><td>19 cm/s</td><td>3.7kHz → 37kHz
−1dB (+0.2, −0)</td><td>R108</td></tr><tr><td>9.5 cm/s</td><td>1.8kHz → 18kHz
−1dB (+0.2, −0)</td><td>R109</td></tr><tr><td>4.8 cm/s</td><td>900Hz → 9kHz
−1dB (+0.2, −0)</td><td>R110</td></tr><tr><td>2.4 cm/s</td><td>450Hz → 4.5kHz
−1dB (+0.2, −0)</td><td>R111</td></tr><tr><td>1.2 cm/s</td><td></td><td></td></tr></table></td><td>TP3 of DR Amp,
adjust VR controls as listed</td><td>Input: sinewave of 0.707V rms to INPUT BNC adjust the listed VRs by each of speeds
setup: USE-CAL: USE
mode: simultaneous record/reproduce at each of speeds</td></tr>
<tr><td>⑥ Reproduce Gain Adj</td><td>0.707V rms
±0.02</td><td>TP4 of DR Amp,
R107 of DR Amp</td><td>Input: sinewave of 3kHz, 0.707V rms to INPUT BNC adjust the listed VRs by each of speeds.
setup: USE-CAL: USE
TAPE-SOURCE: TAPE
Run at 19 cm/s in simultaneous record/reproduce mode.

Note: Use DVM</td></tr>
</table>

<table>
<tr><th>test item</th><th>specifications</th><th>check point/adj location</th><th>setups & adjustment</th></tr>
<tr><td>⑦ Output Gain Adj</td><td>0.707V rms
±0.02</td><td>OUTPUT BNC

R113 of DR Amp</td><td>Input : sinewave of 3kHz, 0.707V rms to INPUT BNC adjust the listed VRs by each of speeds.
setup: USE-CAL: USE
TAPE-SOURCE: SOURCE
OUTPUT: 100kΩ

Note: Use DVM</td></tr>
<tr><td>⑧ Input Impedance</td><td>10kΩ ±1.5kΩ</td><td>INPUT BNC</td><td>Apply a resistance substitution method.
measuring frequency: 1kHz</td></tr>
<tr><td>⑨ Distortion Factor Checkout</td><td>The 3rd harmonics distortion 1% ±0.1%</td><td>OUTPUT BNC</td><td>INPUT BNC: apply a sinusoidal waveform of 3kHz, 0.707V rms and check that the 3rd harmonics (9kHz) component is met with the specified 1% ±0.1% reading at OUTPUT BNC.
setup: USE-CAL: USE
TAPE-SOURCE: TAPE
Run at 19 cm/s in simultaneous record/reproduce mode.</td></tr>
<tr><td>⑩ Frequency Response Checkout</td><td><table><tr><td>speed</td><td colspan="2"></td></tr><tr><td>38 cm/s</td><td></td><td></td></tr><tr><td>19 cm/s</td><td>100~37 kHz</td><td>±3dB</td></tr><tr><td>9.5 cm/s</td><td>100~18 kHz</td><td>±3dB</td></tr><tr><td>4.8 cm/s</td><td>100~ 9 kHz</td><td>±3dB</td></tr><tr><td>2.4 cm/s</td><td>100~4.5kHz</td><td>±3dB</td></tr><tr><td>1.2 cm/s</td><td></td><td></td></tr></table></td><td>OUTPUT BNC</td><td>Input BNC: apply sinewave of 0.707V rms. Adjust OUTPUT GAIN ADJ control to see if a 0dB is obtained corresponding to SOURCE level, then check that values by speeds listed in the left table are within tolerance.</td></tr>
<tr><td>⑪ 0dB fluctuation by Speeds</td><td>±1.5dB</td><td>OUTPUT BNC</td><td>Record 3kHz, 0.707V rms signal at 19 cm/s, then check that reproduced level fluctuation is with tolerance at each of tape speeds.</td></tr>
<tr><td>⑫ Output Impedance</td><td>82Ω ±10%</td><td>OUTPUT BNC</td><td>Apply a resistance substitution method (Measuring freq: 1kHz)</td></tr>
<tr><td>⑬ SN Ratio Checkout</td><td><table><tr><td>speed</td><td>(dB)</td></tr><tr><td>38 cm/s</td><td></td></tr><tr><td>19 cm/s</td><td>30</td></tr><tr><td>9.5 cm/s</td><td>30</td></tr><tr><td>4.8 cm/s</td><td>30</td></tr><tr><td>2.4 cm/s</td><td>30</td></tr><tr><td>1.2 cm/s</td><td></td></tr></table></td><td>OUTPUT BNC</td><td>Setups are all the same with Freq Response checkout. Measurement is done to see values by speed.
Input BNC: apply 0V

Note: The 0dB defines that reproduced output is read with an input of 3kHz, 0.707V rms recorded at 19 cm/s.</td></tr>
<tr><td>⑭ Crosstalk Measurement</td><td>30dB</td><td>OUTPUT BNC</td><td>This check is made directly after the S/N measurement setups remained only at 19cm/s.
Under measurement Input BNC: 0V
For other DR channel, apply sinewave of 37kHz, 0.707V (No signal is applied for FM channels).</td></tr>
<tr><td>⑮ Output Voltage Level Checkout</td><td>Greater than 1.414V rms
±0.07V rms
(1.344 ~ 1.482)</td><td>OUTPUT BNC

R113</td><td>Input BNC: apply a sinewave of 3kHz, 0.707V rms then check Output voltage.
setup: USE-CAL: USE
TAPE-SOURCE: SOURCE
mode of operation: STOP
OUTPUT: 100kΩ</td></tr>
</table>

test item	specifications	check point/adj location	setups & adjustment

⑯ Operation Control Checkout

	MONITOR				SOURCE			
	SOURCE		TAPE		SOURCE		TAPE	
	1V	OUT	1V	OUT	1V	OUT	1V	OUT
STOP	A - A (0.707)		0V		A - A (1.414)		0V	
RES FWD	A - A (0.707)		reproduce data (0.707)		A - A (1.414)		reproduce data (1.414)	
FWD	reproduce data (0.707)	reproduce data (1.414)	reproduce data (0.707)	reproduce data (1.414)	reproduce data (1.414)		reproduce data (1.414)	
FF/RWD	0V		0V		0V		0V	

Input BNC: apply a signal of 0.707V rms set and hold Output Gain control to 1.414V rms.

Note: 1) When an output is appearing during FF/RWD mode, set S1 of DR Amp to position 1.
2) Values in brackets are V rms.
3) Columns of 1V & OUT are set with 1V/OUT switch of the side panel.

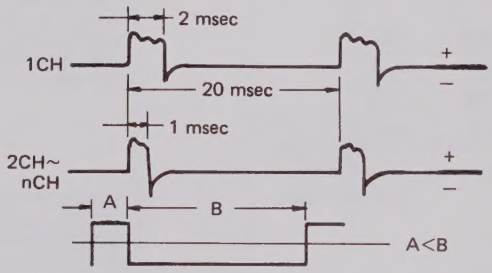
⑰ CAL voltage Fluctuation by Channel

±0.5dB

Set position for LEVEL VR of INPUT AMP is identical with item 3) of the Preparation & Precaution Instructions.

setup: METER: AC
TAPE-SOURCE: SOURCE
USE-CAL: CAL
check that the value specified coincidents to a Meter pointer. (DR channel only).

⑱ Polarity Checkout



During reproducing the polarity test tape, check a portion of wave-form as shown coincidents to that of measurement.

When pressing PLAY/REC with applied wave-form as shown in the left check that the tested wave-form is identical.

Note: Basically, the channel-7 of XR-30 and the channel 13 -14 of XR-50 are unable to be changed to DR since these channles are assigned for specific functions.

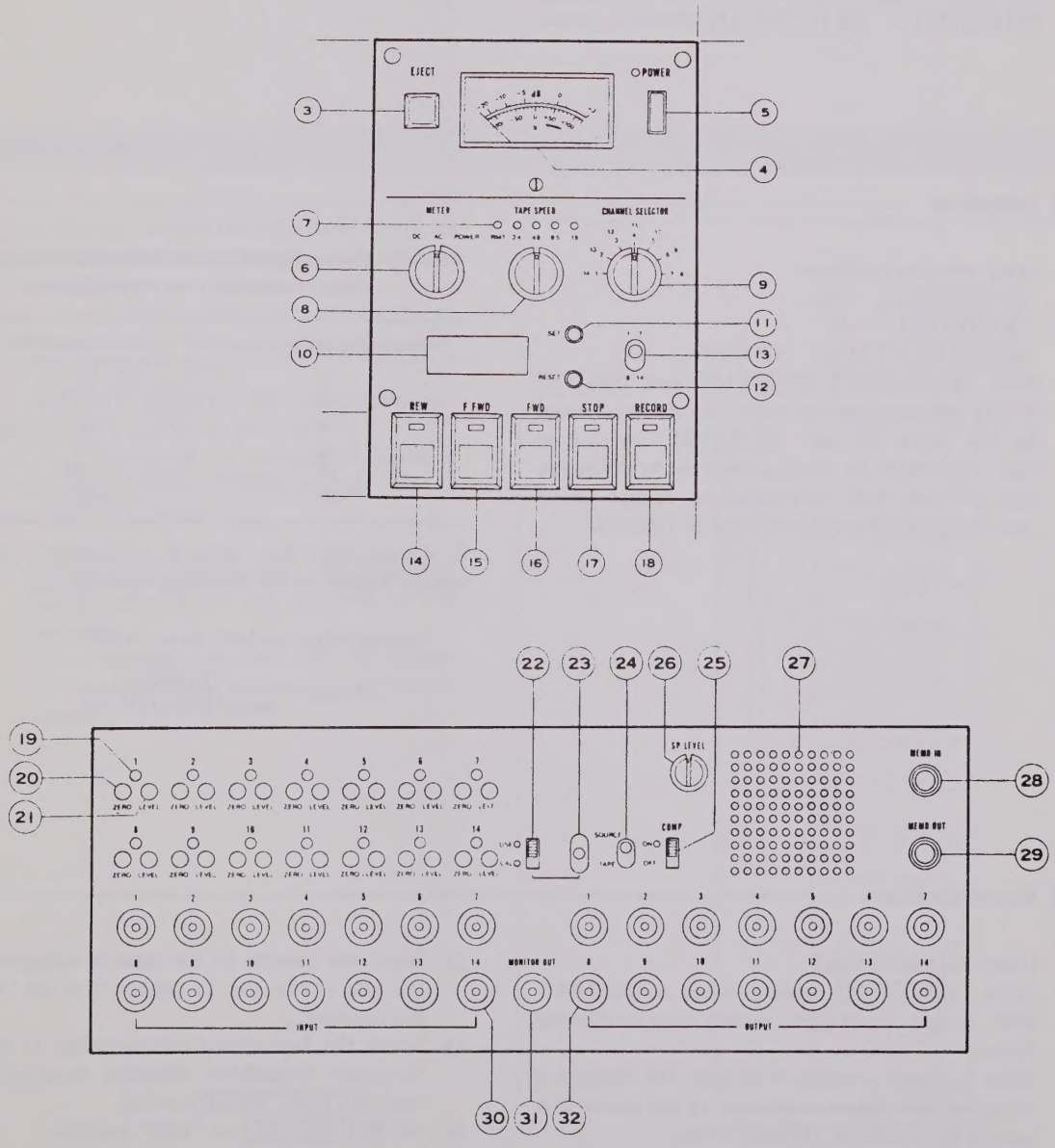
5. Operating Instructions

These amplifier units were designed to solely equip into the XR SEries recorder (using V-cassette tape), compatible with the standard FM Record/Reproduce Amp units (further adjustment and input impedance conversion jobs are necessary as descriptions given in the previous Section). To change units from the FM to DR, refer to Section 4, Page 2.

The major different points from the FM Amplifier are as follows.

Item	DR Amp	FM Amp
Input impedance	10kohms	1Megohms
CAL voltage	2V p-p, 500Hz	±1, 0V
Output Zero shift	none	±10%
Frequency Response	refer to the specifications	

Front View



6. Recording Data

Refer to the Controls and Functions shown in the Operating Instructions of the main recorder.

6.1 Checking Input Zero Adj.

1) Press ⑤ [POWER] switch to Power-on and keep it for 20 to 30mins warm up run.
2) Setup the following switches to:
   ㉒ [USE/CAL] USE position
   ⑥ [METER] DC
   ㉔ [SOURCE/TAPE] SOURCE
3) With no connection to [INPUT] BNC, select the desired channel for DR by ⑨ [CHANNEL SELECTOR], ⑬ [1~7/8~14] switches, check that a pointer of level meter points to "0" with no failure. If an error of about ±5%, this will not affect to the total performance. When it is largely deviated from the specified, adjust ⑳ [ZERO] VR for "0" division of the meter. If an output zero of signal source is also varied far apart, it is possible to algin correctly by the same Instructions.

6.2 Calibration

1) Setup switches as follows:
   ㉒ [USE/CAL] CAL
   ⑥ [METER] AC
   ㉔ [SOURCE/TAPE] SOURCE
2) With ⑨ [CHANNEL SELECTOR] and ⑬ [1~7/8~14] switches together, select the desired channel for DR, adjust and set ㉑ [LEVEL] pot. VR to align the GAIN by reading level meter reflection that matches with corresponding voltage to be recorded (peak to peak level, refer to Table-1).

Table 1 Recording voltage vs level meter reading values (input sensitivity) during calibration

Recording voltage (Vp-p)	Level meter (dB)
2	0
3	− 3.5
4	− 6
8	−12
15	−17.5
20	−20

If a case other than listed is encountered, recording voltage is given by the following formula:

reading values on level meter in dB =

$$20 \log_{10} \frac{2\,(\text{Vp-p})}{\text{record v level (Vp-p)}}$$

6.3 Record the Data

1) Connecting input signal
   Using ㉚ [INPUT] cable attached to the INPUT BNC, connect input signal leading from an external device.
   Since an input impedance of each DR channel is 10kohms, use output connector of the device that have an impedance of 100ohms or less.
2) Insert the cassette to the cassette compartment of the unit (Refer also to Section 5 of the Operating Instructions).
3) Select the Tape Speed corresponding to recording frequency bandwidth, recording duration in time with ⑧ [TAPE SPEED] switch.
4) Set ㉒ [USE/CAL] to "USE" position.

5) Set ⑪ [SET] switch for a start position of recording at arbitrary value, and/or cause ⑫ [RESET] switch to clear the T/C value to "0000".
6) Depress each of ⑯ [FWD] and ⑱ [RECORD] switches simultaneously.
To record a calibration signal in prior to record the data, apply also the same procedure to record this calibration signal with additing ㉒ [USE/CAL] to "CAL".

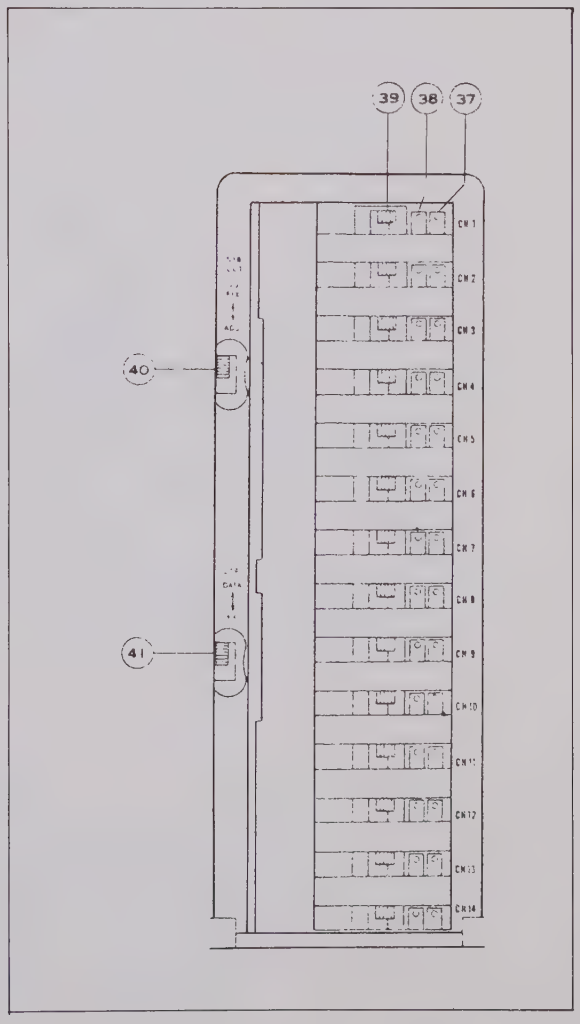
Notes: 1) Because of having a overload limiting function against the excessive level over 150% of Input sensitivity, give special cares for setting input sensitivity before recording the data.

2) Also note that bandwidth is extended far above 100kHz at any speed selected, although input signal is read both on ㉛ [MONITOR OUT] and ④ [LEVEL METER] when [SOURCE/TAPE] switch is placed in "SOURCE" during STOP or RECORD operation.
3) When ㉒ [USE/CAL] switch is set to "CAL", a calibration voltage of 2Vp-p, 500Hz is input regardlessly the ㉓ [+/0/−] switch position may be.
4) ㉕ [COMP ON/OFF] function is ignoered during operating in DR channel.

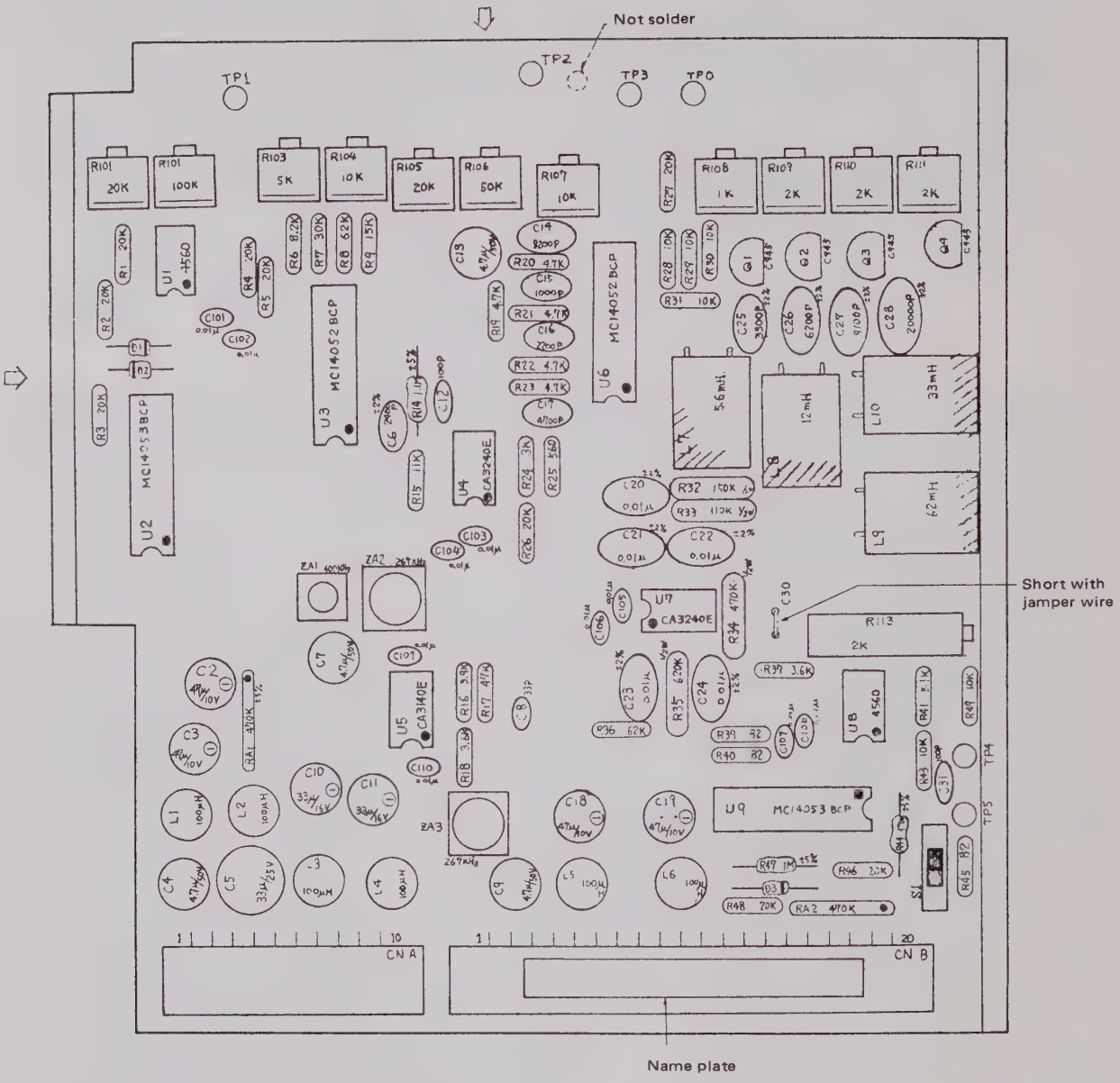
7. Reproducing the Data

1) To adjust Output, remove the right hand side panel of the main recorder unit (Section 2-4-3 of Operating Instructions).
2) Connect output signal from the recorder to an external device using the attached output cable through ㉜ [OUTPUT] BNC.
3) Select ⑧ [TAPE SPEED] to the desired speed and set ㉔ [SOURCE/TAPE] sw to "TAPE".
4) Output level adjustment of reproduced signal is made with ㊳ [OUTPUT LEVEL] control.
5) Depress ⑯ [FWD] control.

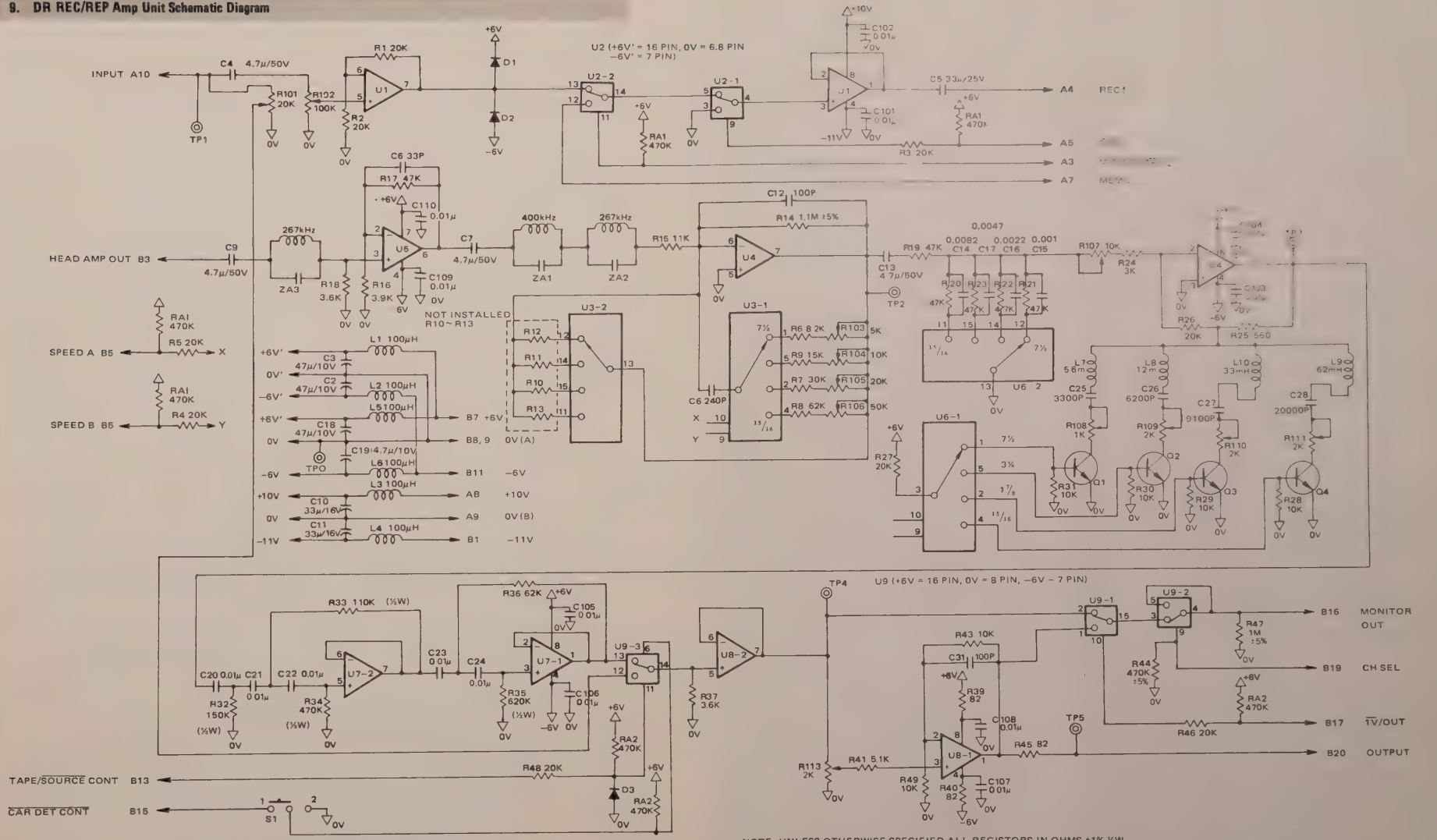
Notes: 1) ㊲ [OUTPUT ZERO] and ㊴ [PHASE ⇔ FREQ] controls are not provided on DR channels.
2) For monitoring functions, refer to Section 2~8 of Operating Instructions of the recorder.



8. DR REC/REP Amp Unit PCBA



9. DR REC/REP Amp Unit Schematic Diagram



NOTE: UNLESS OTHERWISE SPECIFIED ALL REGISTORS IN OHMS ±1% ¼W

D1~3: 1S953
U1.8: NJM4560
U2.9: MC14053BCP
U5: CA3140E
U4.7: CA3240E
U3.6: MC14052BCP (+6V = 16 PIN; 0V = 6.8 PIN; −6V = 7 PIN)
Q1~4: 2SC945
R101: A-TO-A GAIN ADJ
R102: REC CURRENT ADJ

R103: (7½) LOW FRQ EQU ADJ
↓
R106: ($^{15}/_{16}$) LOW FRQ EQU ADJ
R108: (7½) HIGH FRQ EQU ADJ
↓
R111: ($^{15}/_{16}$) HIGH FRQ EQU ADJ
R107: REP GAIN ADJ
R113: OUTPUT GAIN ADJ

TEAC CORPORATION
3-7-3, Naka-cho, Musashino, Tokyo 180, Japan
Phone: (0422) 53-1111

8110.2J D.3780A Printed in Japan